

TOSHIBA Field Effect Transistor with Built-in Schottky Barrier Diode  
Silicon N-Channel MOS Type (Ultra-High-Speed U-MOS III)

## TPCA8A01-H

High Efficiency DC-DC Converter Applications

Notebook PC Applications

Portable Equipment Applications

Unit: mm

- Built-in schottky barrier diode  
Low forward voltage:  $V_{DSF} = -0.6 \text{ V (max)}$
- Small footprint due to a small and thin package
- High speed switching
- Small gate charge:  $Q_{SW} = 11 \text{ nC (typ.)}$
- Low drain-source ON-resistance:  $R_{DS(ON)} = 4.3 \text{ m}\Omega \text{ (typ.)}$
- High forward transfer admittance:  $|Y_{fs}| = 70 \text{ S (typ.)}$
- Low leakage current:  $I_{DSS} = 100 \text{ }\mu\text{A (max)}$  ( $V_{DS} = 30 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.1 \text{ to } 2.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

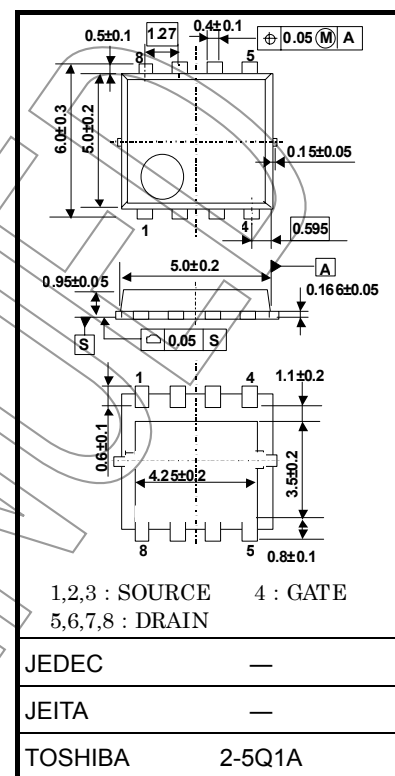
### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

| Characteristic  |                 | Symbol    | Rating     | Unit             |
|---|-----------------|-----------|------------|------------------|
| Drain-source voltage  |                 | $V_{DSS}$ | 30         | V                |
| Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )              |                 | $V_{DGR}$ | 30         | V                |
| Gate-source voltage   |                 | $V_{GSS}$ | $\pm 20$   | V                |
| Drain current   | DC (Note 1)     | $I_D$     | 36         | A                |
|   | Pulsed (Note 1) | $I_{DP}$  | 108        |                  |
| Drain power dissipation ( $T_c = 25^\circ\text{C}$ )              |                 | $P_D$     | 45         | W                |
| Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2a)          |                 | $P_D$     | 2.8        | W                |
| Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2b)          |                 | $P_D$     | 1.6        | W                |
| Single-pulse avalanche energy (Note 3)                            |                 | $E_{AS}$  | 168        | mJ               |
| Avalanche current   |                 | $I_{AR}$  | 36         | A                |
| Repetitive avalanche energy ( $T_c = 25^\circ\text{C}$ ) (Note 4) |                 | $E_{AR}$  | 2.1        | mJ               |
| Channel temperature   |                 | $T_{ch}$  | 150        | $^\circ\text{C}$ |
| Storage temperature range   |                 | $T_{stg}$ | -55 to 150 | $^\circ\text{C}$ |

Note: For Notes 1 to 4, refer to the next page.

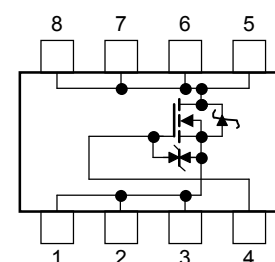
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc.).

This transistor is an electrostatic-sensitive device. Handle with care. Schottky barrier diodes have large-reverse-current-leakage characteristic compared to other rectifier products. This current leakage combined with improper operating temperature or voltage may cause thermal runaway. Please take forward and reverse loss into consideration during design.



Weight: 0.080 g (typ.)

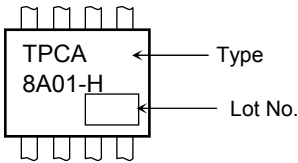
### Circuit Configuration



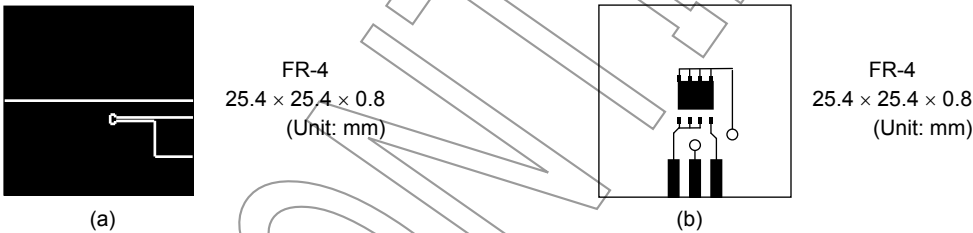
Thermal Characteristics

| Characteristic   | Symbol           | Max  | Unit                 |
|--|------------------|------|----------------------|
| Thermal resistance, channel to case<br>( $T_c=25^{\circ}\text{C}$ )        | $R_{th\ (ch-c)}$ | 2.78 | $^{\circ}\text{C/W}$ |
| Thermal resistance, channel to ambient<br>( $t = 10\ \text{s}$ ) (Note 2a) | $R_{th\ (ch-a)}$ | 44.6 | $^{\circ}\text{C/W}$ |
| Thermal resistance, channel to ambient<br>( $t = 10\ \text{s}$ ) (Note 2b) | $R_{th\ (ch-a)}$ | 78.1 | $^{\circ}\text{C/W}$ |

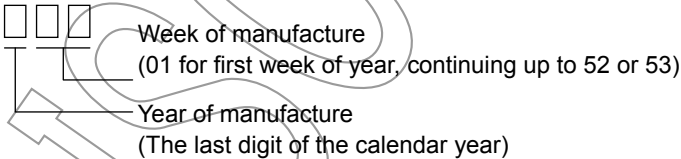
Marking (Note 5)



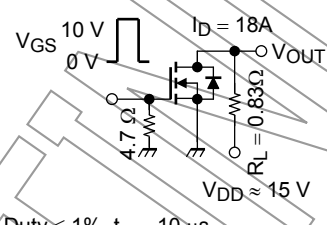
- Note 1: The channel temperature should not exceed 150°C during use
- Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



- Note 3:  $V_{DD} = 24\ \text{V}$ ,  $T_{ch} = 25^{\circ}\text{C}$  (initial),  $L = 0.1\ \text{mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 36\ \text{A}$
- Note 4: Repetitive rating: pulse width limited by max. channel temperature
- Note 5: \* Weekly code: (Three digits)

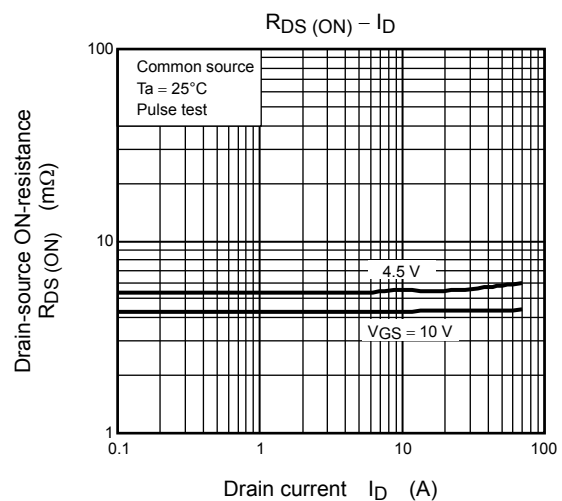
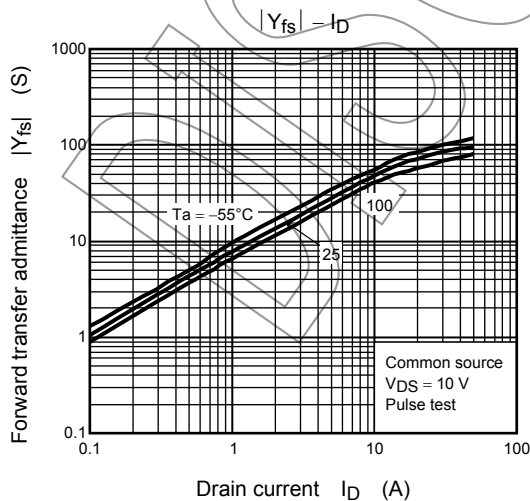
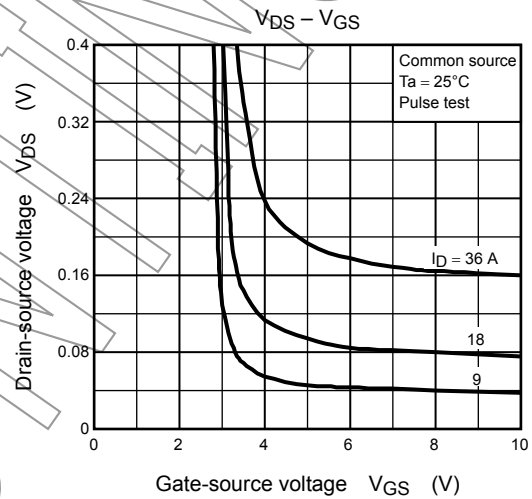
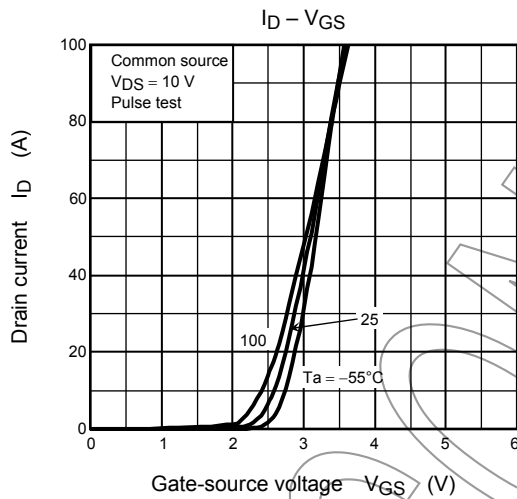
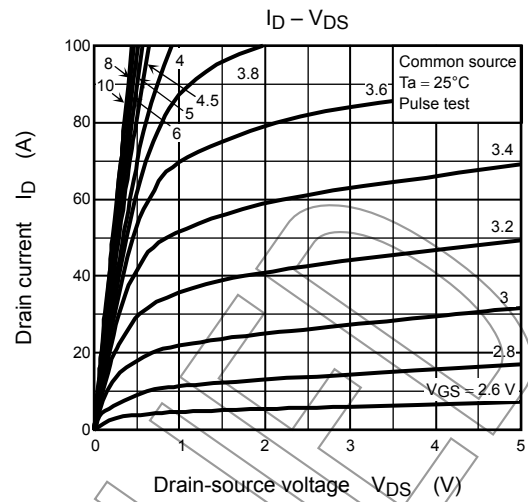
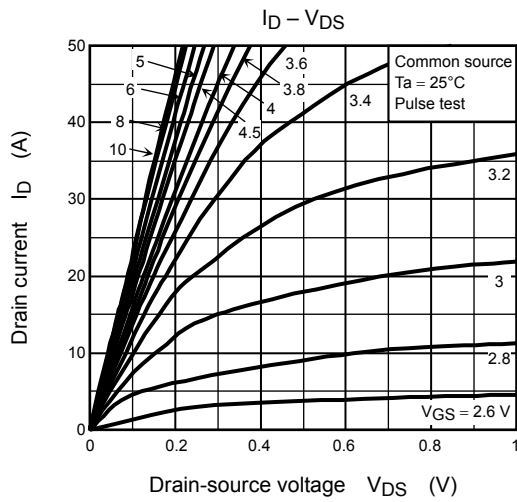


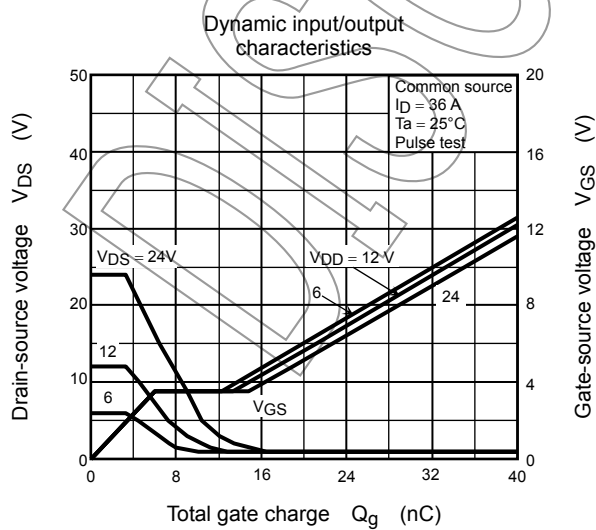
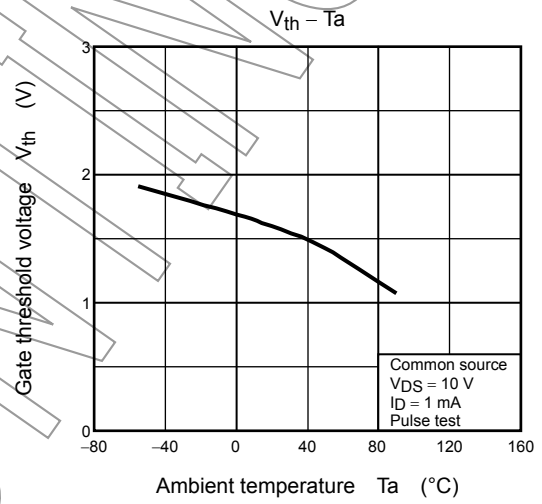
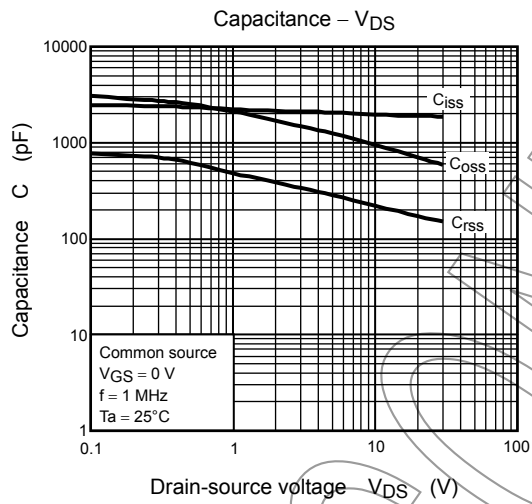
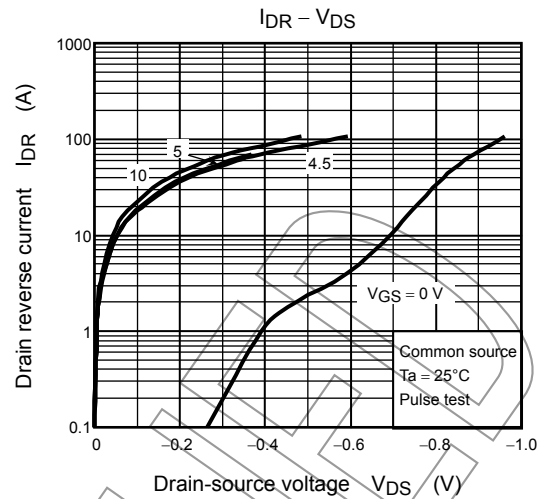
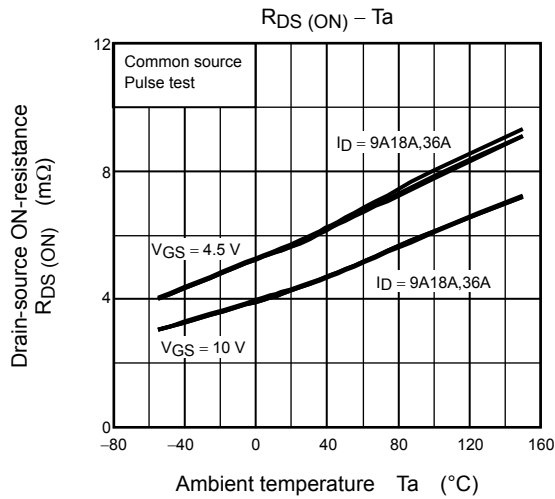
## Electrical Characteristics (Ta = 25°C)

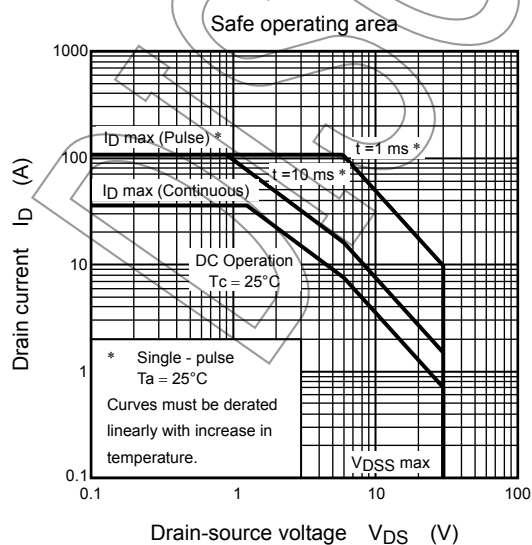
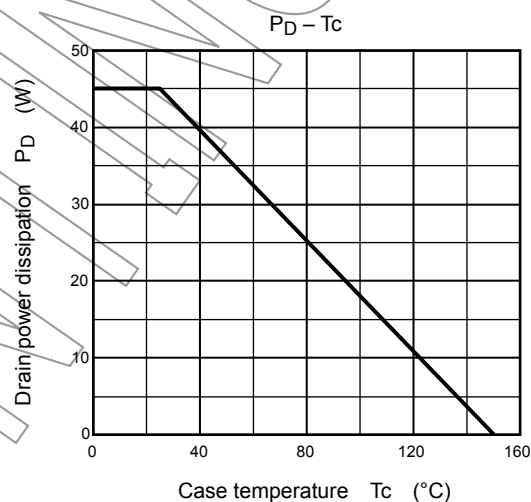
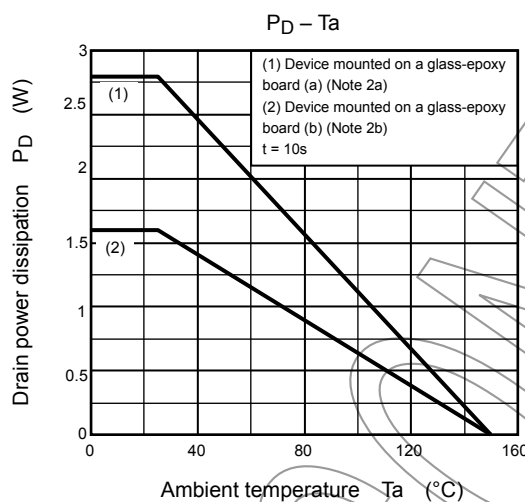
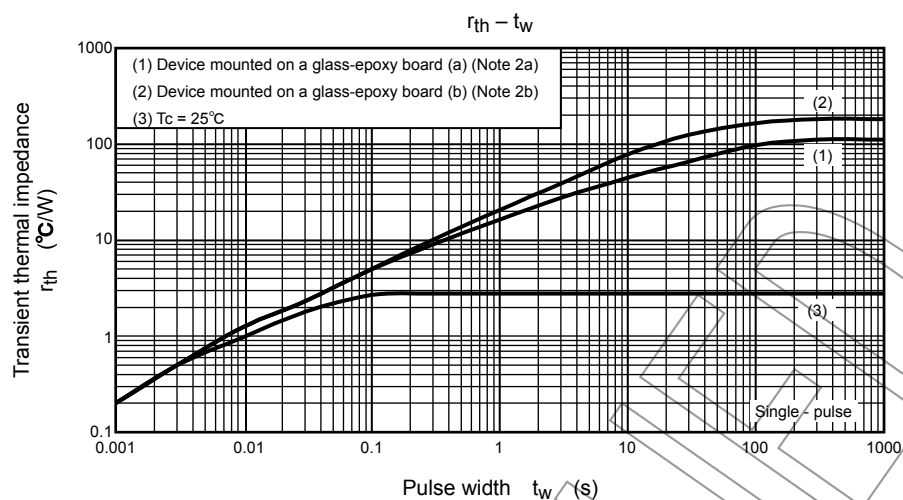
| Characteristic                                  |               | Symbol        | Test Condition  | Min                                      | Typ. | Max      | Unit             |
|---|---------------|---------------|---|--|------|----------|------------------|
| Gate leakage current                            |               | $I_{GSS}$     | $V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$                                   | —  | —    | $\pm 10$ | $\mu\text{A}$    |
| Drain cut-off current                           |               | $I_{DSS}$     | $V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$                                       | —  | —    | 100      | $\mu\text{A}$    |
| Drain-source breakdown voltage                  |               | $V_{(BR)DSS}$ | $I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$   | 30                                       | —    | —        | V                |
|   |               | $V_{(BR)DSX}$ | $I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$                                       | 15                                       | —    | —        |                  |
| Gate threshold voltage                          |               | $V_{th}$      | $V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$   | 1.1                                      | —    | 2.3      | V                |
| Drain-source ON-resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = 4.5 \text{ V}, I_D = 18 \text{ A}$  | —  | 6.2  | 8.5      | $\text{m}\Omega$ |
|   |               |               | $V_{GS} = 10 \text{ V}, I_D = 18 \text{ A}$   | —  | 4.3  | 5.6      |                  |
| Forward transfer admittance                     |               | $ Y_{fs} $    | $V_{DS} = 10 \text{ V}, I_D = 18 \text{ A}$   | 35                                       | 70   | —        | S                |
| Input capacitance                               |               | $C_{iss}$     | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$                    | —  | 1970 | —        | pF               |
| Reverse transfer capacitance                    |               | $C_{rss}$     |   | —  | 240  | —        |                  |
| Output capacitance                              |               | $C_{oss}$     |   | —  | 950  | —        |                  |
| Switching time                                  | Rise time     | $t_r$         |  | —  | 8    | —        | ns               |
|   | Turn-on time  | $t_{on}$      |   | —  | 18   | —        |                  |
|   | Fall time     | $t_f$         |   | —  | 10   | —        |                  |
|   | Turn-off time | $t_{off}$     |   | Duty $\leq 1\%$ , $t_w = 10 \mu\text{s}$ | —    | 44       |                  |
| Total gate charge (gate-source plus gate-drain) |               | $Q_g$         | $V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 36 \text{ A}$            | —  | 35   | —        | nC               |
|   |               |               | $V_{DD} \approx 24 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 36 \text{ A}$             | —  | 19   | —        |                  |
| Gate-source charge 1                            |               | $Q_{gs1}$     | $V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 36 \text{ A}$            | —  | 6    | —        |                  |
| Gate-drain ("Miller") charge                    |               | $Q_{gd}$      |   | —  | 8.8  | —        |                  |
| Gate switch charge                              |               | $Q_{SW}$      |   | —  | 11   | —        |                  |

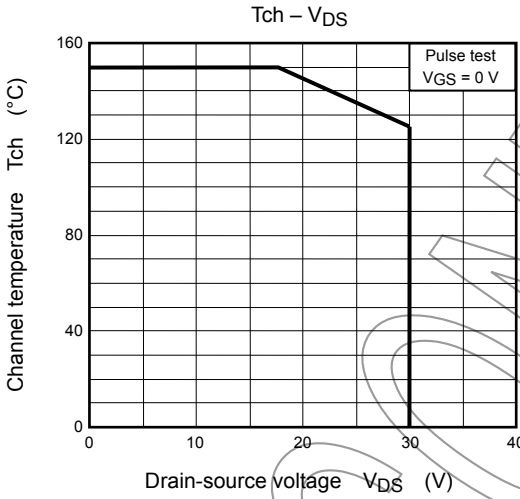
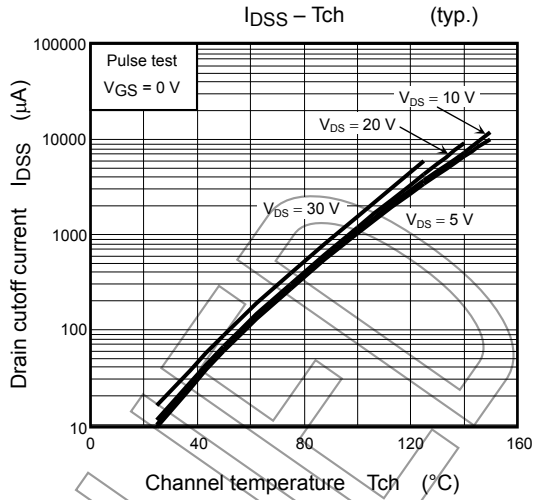
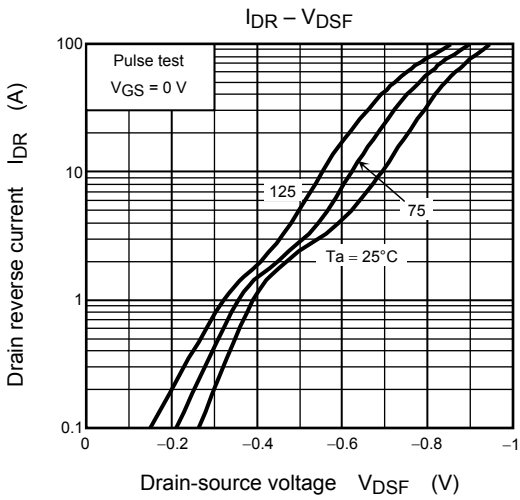
## Source-Drain Ratings and Characteristics (Ta = 25°C)

| Characteristic          |                | Symbol    | Test Condition                                 | Min | Typ.  | Max  | Unit |
|-------------------------|----------------|-----------|--|-----|-------|------|------|
| Peak forward current    | Pulse (Note 1) | $I_{DRP}$ | —  | —   | —     | 108  | A    |
| Forward voltage (diode) |                | $V_{DSF}$ | $I_{DR} = 1.0 \text{ A}, V_{GS} = 0 \text{ V}$ | —   | -0.45 | -0.6 | V    |
|                         |                |           | $I_{DR} = 36 \text{ A}, V_{GS} = 0 \text{ V}$  | —   | —     | -1.2 |      |









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